CLAIMS

We claim:

1. A biocompatible cationic lipopolymer comprising a polyethylenimine (PEI), a lipid, and a biocompatible hydrophilic polymer spacer, wherein the lipid is attached to the PEI back bone via the biocompatible hydrophilic polymer spacer by a covalent bond.

2. The cationic lipopolymer of claim 1, wherein the polyethylenimine has a linear or branched configuration with a molecular weight of between 100-500,000 Daltons.

3. The cationic lipopolymer of claim 1, wherein the covalent bond is an ester, amide, urethane or di-thiol bond.

4. The cationic lipopolymer of claim 1, wherein the lipid is cholesterol, cholesterol derivatives, C_{12} to C_{18} fatty acids, or fatty acid derivatives.

5. The cationic lipopolymer of claim 1, wherein the biocompatible hydrophilic polymer is polyethylene glycol (PEG) having a molecular weight of between 50 to 20,000 Daltons.

6. The cationic lipopolymer of claim 1, wherein molar ratio of PEI to the hydrophilic polymer is within a range 1:0.1 to 1: 500.

7. The cationic lipopolymer of claim 1, wherein molar ratio of the PEI to the lipid is within a range of 1:0.1 to 1:500.

8 The cationic lipopolymer of claim 1 further comprises a targeting moiety which is covalently attached to the PEI back bone directly or through a hydrophilic spacer.

9. The cationic lipopolymer of claim 8, wherein the targeting moiety is selected from the group consisting of transferrin, asialoglycoprotein, antibodies, antibody fragments, low density lipoproteins, interleukins, GM-CSF, G-CSF, M-CSF, stem cell factors, erythropoietin, epidermal growth factor (EGF), insulin, asialoorosomucoid, mannose-6-phosphate, mannose, Lewis^X and sialyl Lewis^X, N-acetyllactosamine, folate, galactose, lactose, and thrombomodulin, fusogenic agents, lysosomotrophic agents, and nucleus localization signals (NLS).

10. The cationic lipopolymer of claim 8, wherein the covalent bond is an ester, amide, urethane, or dithiol bond.

11. The cationic lipopolymer of claim 8, wherein the molar ratio of the cationic lipopolymer and the targeting moiety is within a range of 1:0.1 to 1:100.

12. A cationic lipopolymer comprising a polyethylenimine (PEI), a lipid, and a biocompatible hydrophilic polymer, wherein the lipid and the biocompatible hydrophilic polymer are directly and independently attached to the PEI backbone by a covalent bond.

13. The cationic lipopolymer of claim 12, wherein the polyethylenimine has a linear or branched configuration with a molecular weight of between 100-500,000 Daltons.

14. The cationic lipopolymer of claim 12, wherein the covalent bond is an ester, amide, urethane, ether, carbonate or di-thiol bond.

15. The cationic lipopolymer of claim 12, wherein the lipid is cholesterol, cholesterol derivatives, C_{12} to C_{18} fatty acids, or fatty acid derivatives.

16. The cationic lipopolymer of claim 12, wherein the biocompatible hydrophilic polymer spacer is polyethylene glycol (PEG) having a molecular weight of between 50 to 20,000 Daltons.

17. The cationic lipopolymer of claim 12, wherein the molar ratio of the PEI to the lipid is within a range of 1:0.1 to 1:500.

18. The cationic lipopolymer of claim 12 further comprises a targeting moiety which s covalently attached to the PEI backbone directly or through a hydrophilic spacer.

19. The cationic lipopolymer of claim 18, wherein the targeting moiety is selected from the group consisting of transferrin, asialoglycoprotein, antibodies, antibody fragments, low density lipoproteins, interleukins, GM-CSF, G-CSF, M-CSF, stem cell factors, erythropoietin, epidermal growth factor (EGF), insulin, asialoorosomucoid, mannose-6-

phosphate, mannose, Lewis^X and sialyl Lewis^X, N-acetyllactosamine, folate, galactose, lactose, and thrombomodulin, fusogenic agents, lysosomotrophic agents, and nucleus localization signals (NLS).

20. The cationic lipopolymer of claim 18, wherein the covalent bond is an ester, amide, urethane, or dithiol bond.

21. The cationic lipopolymer of claim 18, wherein the molar ratio of the cationic lipopolymer and the targeting moiety is within a range of 1:0.1 to 1:100.

22. A complex formed between a nucleic acid and a cationic lipopolymer of claim 1 in a N/P (nitrogen atoms on polymer/ phosphate atoms on DNA) ratio within a range of 0.1/1 to 500/1.

23. A complex formed between a nucleic acid and a cationic lipopolymer of claim 8 in a N/P (nitrogen atoms on polymer/ phosphate atoms on DNA) ratio within a range of 0.1/1 to 500/1.

24. A complex formed between a nucleic acid and a cationic lipopolymer of claim 12 in a N/P (nitrogen atoms on polymer/ phosphate atoms on DNA) ratio within a range of 0.1/1 to 500/1.

25. A complex formed between a nucleic acid and a cationic lipopolymer of claim18, in a N/P (nitrogen atoms on polymer/ phosphate atoms on DNA) ratio within a range of 0.1/1 to 500/1.

26. A liposome comprising a biocompatible cationic lipopolymer of claim of 1 and a helper lipid in a molar ratio within a range of 1:0.1 to 1:500.

27. The liposome of claim 26, wherein the helper lipid is a member selected from the group consisting of cholesterol, dioleoylphosphatidylethanolamine(DOPE), oleoylpalmitoyl-phosphatidylethanolamin(POPE), diphytanoylphosphatidylethanolamin (diphytanoylPE), disteroyl-, -palmitoyl-, -myristoylphosphatidylethanolamine and 1- to 3-fold N-methylated derivatives.